

SUBSTITUTE SPECIFICATION

LARGE-CAPACITY VEHICLE FOR TRANSPORTING PEOPLE, ESPECIALLY A RAIL VEHICLE, COMPRISING CARRIAGES THAT ARE CONNECTED IN AN ARTICULATED MANNER

[0001] This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/EP2004/008823 which has an International filing date of August 6, 2004, which designated the United States of America and which claims priority on German Patent Application number 103 43 536.0 filed September 19, 2003, the entire contents of which are hereby incorporated herein by reference.

Field

[0002] The invention generally relates to a large-capacity vehicle for transporting people, for example a rail vehicle. For example, it may relate to one which has carriages (such as car bodies, for example) which are coupled by articulated connections, at least two carriages of which are respectively supported on a bogie or set of running gear (undercarriage), wherein all the articulated connections permit turning movements of the carriages about the vertical axis when cornering. Further, in a vehicle which has more than three parts, at least one articulated connection is embodied in such a way that the vehicle can carry out pitching movements about the transversal axis when traveling through a depression or over an elevation.

Background

[0003] In the periodical Der Nahverkehr [Local Transportation], No. 6/1996, pages 48 to 53, an innovative shell construction for a modular tram vehicle is described. In the four-part

prototype vehicle which is shown in Figure 2 of this reference a car body which is configured in the manner of a bridge (central module) is connected in an articulated fashion to two carriages which are each supported on a dual-axle set of running gear (dual-axle running gear modules). The prototype vehicle also has a car body which rests on a single-axle set of running gear (single-axle running gear module).

[0004] The lower articulated connections include vehicle joints which can move in a spherical fashion and are rigidly connected to the carriages by brackets. These lower joints, which are disclosed as an assembly in, for example, DE 101 39 970 A1, permit pivoting movements and in theory also pitching and rolling movements. The first embodiment of the above joints which is arranged between the central module and the two dual-axle running gear modules in the prototype vehicle only permit a pivoting movement about the vertical axis (z axis).

[0005] A second embodiment of the above joint which is arranged between the car body with the single-axle running gear module and the central module in the prototype also permits the vehicle to carry out a pitching movement about the transversal axis when traveling through a depression or over an elevation. With this second embodiment of the joints, the carriages are connected by way of a transversal connector which acts on a respective bracket of the two carriages.

[0006] In the modular vehicle explained above and also in other so-called multi-joint vehicles - see in this respect the periodical Railway Gazette 2003, pages 57 to 64, for example Fig. 4 "Dresden NGTD 6", Fig. 6 "Citadis" and Fig. 7 "Cityrunner" - joints are therefore used which permit either only pivoting of the carriages about the vertical axis or pivoting and pitching of the carriages about the vertical axis or about the transversal axis. In certain track situations

(such as in particular elevations in the track in bends or twists in the track) torsion may occur in the carriages resulting in high stresses on the structure of the carriages. Even if the carriages are dimensioned to cope with these high stresses, overloading and damage to the car body structures when traveling cannot be ruled out.

[0007] At least one embodiment the invention is therefore based on an object of embodying a large-capacity vehicle with the generic features in the simplest possible way such that overloading and damage to the car body structures are reliably avoided in all track situations.

[0008] An object may be achieved according to at least one embodiment of the invention in such a way that one of the articulated connections has a connecting element which is embodied and connected to two carriages in such a way that pivoting and rolling movements about the longitudinal axis of the vehicle are made possible. The connecting element can be embodied as a rigid connector rod and can be connected to the two carriages via ball and socket joints. Alternatively, it is possible to connect the connecting element as a twistable connector rod and to connect it to the two carriages via single-axle joints.

[0009] Since, according to at least one embodiment of the invention, one of the articulated connections permits a pivoting and rolling movement of the carriages, the wagon bodies are advantageously not subjected to any torsional stress which could cause damage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention will be described in more detail below with reference to example embodiments which are each illustrated in their basic form in the drawings.

[0011] Figs 1 to 3 show two carriages of a rail vehicle with a first embodiment of the articulated connection according to the invention. Fig. 1 shows the neutral position, Fig. 2 shows a pure rolling movement and Fig. 3 shows a pure pivoting movement.

[0012] Fig. 4 shows two carriages of a rail vehicle with a second embodiment of the articulated connection according to the invention in a neutral position.

[0013] Figs 5, 6 and 7 each show different embodiments and arrangements of a component for limiting the rolling movements using the example of the first embodiment of the articulated connection according to Fig. 1.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

[0014] The carriages 6, 7 are preferably components of a rail vehicle which is of modular design and has, for example, a total of three, five or more carriages. The car body 6 can be supported on a bogie or set of running gear, while the car body 7 is embodied in the manner of a bridge and is borne by the supported car body 6 and a further supported car body (6) which is arranged to the right of the bridge-like car body 7 in the plane of the drawing in Figs 1 to 7. However it is also conceivable to support all the carriages on bogies or sets of running gear.

[0015] All the carriages of the multi-part rail vehicle are coupled by way of articulated connections which permit turning movements of the carriages about the vertical axis when the vehicle travels through a bend. In a rail vehicle which has more than three parts, at least one articulated connection is embodied in such a way that the vehicle can carry out pitching movements about the transversal axis when traveling through a

depression or over an elevation. So that rolling movements of the carriages 6, 7 about the longitudinal axis of the vehicle are also permitted, the articulated connection shown has a connecting element 2 which, according to Figs 1 to 3 and 4 to 7, is embodied as a rigid connector rod and is connected to the two carriages 6, 7 by way of ball and socket joints 3, 4.

[0016] In the alternative embodiment which is shown in Fig. 4, the connecting element 2 is embodied as a twistable connector rod and is connected to the two carriages 6, 7 by use of single-axle joints 8, 9. In the lower region, the carriages 6, 7 are coupled by use of a vehicle joint 1 which can move in a spherical fashion. One of the rotational axes which is formed by the ball and socket joints 3, 4 or by the single-axle joints 8, 9 and the rotational axis of the vehicle joint 1 preferably lie on the same vertical axis 10. As a result of this, satisfactory pivoting about the vertical axis is possible.

[0017] The rolling movement is basically limited by the length of the connecting element 2. However, it is recommended to limit the rolling movements by a component 5 which has a damping function and includes the function of a stop. Furthermore, the component 5 can have a spring-loading function. According to Fig. 5, the component 5 acts on the two carriages 6, 7. According to Figs 6 and 7, the component 5 can also be arranged in such a way that it acts on one of the carriages 6, 7 at one end, and on one of the ball and socket joints 3, 4 at the other. The arrangements, shown in Figs 5 to 7, of the component 5 which limits the rolling movements can readily be transferred to the second embodiment of the articulated connection according to at least one embodiment of the invention which is illustrated in Fig. 4.

[0018] Example embodiments being thus described, it will be obvious that the same may be varied in many ways. Such

variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.